# Andrew Mah

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https://andrewmah44.github.io/

## Education

**New York University** — New York City, NY

*Ph.D., Neural Science* — *Aug. 2018 – May 2024*

*Thesis: Hidden State Inference Modulates Reward Learning but Not Striatal Dopamine Release.*

*Advisor: Dr. Christine Constantinople*

**Washington and Lee University** — Lexington, VA

*B.S. with Honors, Neuroscience and Mathematics, Magna Cum Laude* — *Aug. 2014 – May 2018*

## Experience

**Flatiron Research Fellow** — New York City, NY

*Center for Computational Neuroscience, Flatiron Institute* — *Jan. 2025 - Present*

- Co-derived theoretical bounds on the error of linear recurrent networks approximating Bayesian filtering in Hidden Markov models.
- Validated the theoretical predictions by training linear recurrent networks on 230 randomly generated and adversarial hidden Markov models using custom JAX and Slurm pipelines on GPU clusters.
- Identified a low-dimensional hidden-state drift associated with failures of length generalization and developed tools for stabilizing model representations, maintaining high performance for sequence up to 100x training length.
- Helped organize a Neuro-AI research subgroup of up to 10 researchers, organizing project discussions, technical presentations, and collaborations across neuroscience and machine learning.

**Graduate Research Scientist** — New York City, NY

*Center for Neural Science, New York University* — *June 2019 - Dec. 2024*

- Led behavioral, computational, and neural studies of how animals infer hidden task states during reward-guided decision-making, resulting in two first-author publications.
- Developed standardized MATLAB and MySQL software for processing multimodal behavioral and neural data, achieving adoption by 11+ lab members and supporting analyses in 6+ peer-reviewed publications.
- Awarded a competitive National Institute of Mental Health F31 predoctoral fellowship supporting research on hidden-state inference in rodents.

## Publications

**Mah, A.***, Pughe-Sanford, J.L.*, Harvey, S.E., Williams, A.H. (2026) Linear approximations to HMM filtering. Advances in Neural Information Processing Systems. (* equal contribution)

Toporikova, N., Cheng, W., Qian, L., **Mah, A.**, Clarke, T., Jones, T. C., Moore, D., & Ayoub, N. A. (2026). Phase response curve and RNA-sequencing demonstrate spiders' sensitivity to light and pinpoint candidate light-responsive genes. *PLOS ONE*, 21(9). DOI: 10.1371/journal.pone.0344063

Toporikova, N., Cheng, W., Qian, L., **Mah, A.**, Clarke, T., Jones, T. C., Moore, D., & Ayoub, N. A. (2026). Phase response curve and RNA-sequencing demonstrate spiders' sensitivity to light and pinpoint candidate light-responsive genes. *PLOS ONE*, 21(9). DOI: 10.1371/journal.pone.0344063

Schiereck, S. S., Pérez-Rivera, D. T., **Mah, A.**, DeMaegd, M. L., Hocker, D., Ward, R. M., Savin, C., & Constantinople, C. M. (2026). The orbitofrontal cortex updates beliefs for state inference. *Neuron*, 114(3), 507–520. DOI: 10.1016/j.neuron.2025.10.024

Golden, C. E., Martin, A. C., Kaur, D., **Mah, A.**, Levy, D. H., Yamaguchi, T., Lasek, A. W., Lin, D., Aoki, C., & Constantinople, C. M. (2025). Estrogen modulates reward prediction errors and reinforcement learning. *Nature Neuroscience*, 1–13. DOI: 10.1038/s41593-025-02104-z

**Mah, A.**, Golden, C. E., & Constantinople, C. M. (2024). Dopamine transients encode reward prediction errors independent of learning rates. *Cell Reports*, 43(10). DOI: 10.1016/j.celrep.2024.114840

**Mah, A.**, Schiereck, S. S., Bossio, V., & Constantinople, C. M. (2023). Distinct value computations support rapid sequential decisions. *Nature Communications*, 14(1), 7573. DOI: 10.1038/s41467-023-43250-x

**Mah, A.**, Ayoub, N., Toporikova, N., Jones, T. C., & Moore, D. (2020). Locomotor activity patterns in three spider species suggest relaxed selection on endogenous circadian period and novel features of chronotype. *Journal of Comparative Physiology A*, 206(4), 499–515. DOI: 10.1007/s00359-020-01412-y

## Presentations and Conferences

**Mah, A.**, Williams, A.H. (2026) Representational Drift as a Mechanism of Length-Generalization Failure. Symmetry and Geometry in Neural Representations Workshop, Neural Information Processing Systems. Sydney, Australia. Poster

**Mah, A.**, Williams, A.H.. (2025) Linear Recurrent Networks Approximate Optimal Filtering in Hidden Markov Models. UniReps Workshop, Neural Information Processing Systems. San Diego, California. Poster

**Mah, A.**, Golden, C.E.M., Jang, H., Constantinople, C.M. (2024) Mesolimbic dopamine encodes reward prediction errors independent of learning rates. COSYNE. Lisbon, Portugal. Poster

**Mah, A.**, Golden, C.E.M., Constantinople, C.M. (2023) Neural Instantiation of a Dynamic Learning Rate. Society for Neuroscience. Washington, D.C. Poster.

**Mah, A.**, Constantinople, C.M. (2022) Optimists and realists: heterogeneous priors in rats performing hidden state inference. COSYNE. Lisbon, Portugal. Poster.

**Mah, A.**, Schiereck, S., Bossio, V., Constantinople, C. (2021). Rats infer hidden-states in a temporal wagering task. Society for Neuroscience. Poster.

**Mah, A.**, Li Y., Constantinople, C. (2021). Using neuromodulatory dynamics to arbitrate between distinct behavioral strategies. Society for Neuroscience Global Connectome: A Virtual Event. Poster

**Mah, A.**, Ayoub, N., Jones T.C., Moore, D., Toporikova, N. (2017). Computational model of circadian rhythms predicts adaptive value of exceptionally short period spider clock via flexible entrainment. Society for Neuroscience. Poster.

**Mah, A.**, Ayoub, N., Vienneau-Hathaway, J. (2016) Do RTA-clade spiders possess the same suite of silk genes as orb-web weaving spiders? International Congress of Arachnology. Poster.

## Grants and Fellowships

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|---|---|
| Ruth L. Kirschstein National Research Service Award (NRSA) Predoctoral Fellowship, NIMH. | 2023 - 2025 |
| 2T32MH019524 – Training Systems and Integrative Neuroscience. | 2021 - 2023 |
| 5T90DA043219 – Training Program in Computational Neuroscience. | 2019 - 2021 |
| Henry Mitchell McCracken Fellowship, New York University. | 2018 - 2021 |
| The Jarrard Award for Distinguished Neuroscience Research. | 2018 |
| Taylor Scholarship for Excellence in Mathematics. | 2017 |